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Revision

SOIL DRIFTING

ITS CAUSES AND CONTROL

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Cover Picture

A good trash cover on the Lethbridge Experimental Farm. The green grain approaching heading on either side of the trash covered fallow strip indicates that the season is about midsummer. The summerfallow has been tilled twice, yet the stubble remains on top of the ground and still quite erect. Such careful summerfallow practice provides adequate trash cover, good weed control and moisture conservation.

SOIL DRIFTING – ITS CAUSES AND CONTROL

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In the period between 1930 and 1940 wind erosion devastated many large areas of agricultural land in Western Canada. Homes were abandoned and suffering was widespread. It became apparent to farmers, townspeople, and legislators that soil drifting was a serious national problem. Agricultural scientists and farmers sought improved methods of field husbandry to protect the soil. Strip farming, surface tillage, and trash cover came into fairly general use and proved very helpful in the control of soil drifting. Of great assistance also was the fact that a series of relatively wetter years ensued. Although there has been considerable local drifting every season, general wind erosion over the entire prairie area has not occurred during subsequent years.

Many farmers, particularly those in the drier areas, are still practising good soil drifting control measures. However, when the urgency of control is less acute some are inclined to adopt a complacent attitude and do not take proper precautions to hold their soil. In many areas strip farming is not practised and large blocks of "black" summerfallow are the rule. Often these are smoothed down to fine structure by overworking. On only a small fraction of the summerfallow of the prairies is sufficient care exercised in the preservation of trash cover. Constant vigilance must replace complacency if the challenge of soil drifting is to be met.

Large-scale wind erosion is devastating but localized erosion is insidious. Every year newly seeded crops are blown out, roads, fence lines and shelterbelts are damaged, borrow pits filled, and precious topsoil carried away because some fields were left unprotected.

CAUSES

Exposed Soil

Soil drifting is caused by the action of wind on exposed soil of a certain particle size. Smooth unprotected surfaces are the most susceptible. A wind velocity of 13 to 15 m.p.h. at one foot height will cause drifting on a field where the soil particles are small and there is no protection. The particles that are most susceptible to drifting are those below 1/50 of an inch in diameter. Particles larger than 1/25 inch are quite stable because of weight. The ordinary forces of weathering and abrasion, together with tillage, tend to create particles within the susceptible size ranges. Hence tillage must be conducted so that protection will be provided for the small sized soil grains.

It requires a relatively strong wind to start drifting on a field for the first time. This is because of surface crusts and the natural tendency of the fine material to sift down and receive protection from the large clods. However,

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once a field has drifted and a certain amount of dune material has accumulated, it requires much less wind velocity to bring about soil drifting. When the soil from a field begins to drift it continues until all the susceptible-sized materials are blown away or until the wind stops. Soil on a field that has blown badly has lost the very fine particles which act as cementing agents, when the soil is wet, to form the larger aggregates. This is especially true on the coarser textured soils.

Figure 1.—Buried fences, barren fields, blocked roads, and abandoned homes are the travelling companions of soil drifting. A recurrence of such catastrophies can be prevented only by following approved methods of soil drifting control.

Improper use of Tillage Implements

Often fields are predisposed to soil drifting by improper tillage practices. One of the most common and most serious mistakes is the operation of disk implements improperly adjusted, at a high rate of speed, or at too great a depth. These implements should be operated as shallow as possible, consistent with good weed kill, and never faster than 3-3½ m.p.h. When pulled too fast they pulverize the soil—if too deep, they bury the trash.

The disk harrow and spike-tooth harrow usually cause excessive soil pulverization and seldom should be used for tillage where there is danger of soil drifting. These implements are sometimes useful in emergency control measures.

Surface packers (rollers, crowfoot packers, cultipackers) are not recommended because they break up clods and flatten stubble and trash. However, subsurface packers, which are designed with more widely spaced Vee-wheels, have proved useful to firm the seedbed after spring seeding; such packers do not pulverize the soil excessively.

In all tillage operations the farmer should aim to preserve the trash cover and the small clod structure. Soils slake down most seriously when

tilled in a slightly moistened condition such as after a light shower of rain and hence cultivation at this time should be avoided. Greatest clod of formation occurs when tillage is done on fairly wet soils. Duckfoot cultivators, blade cultivators, and rod weeders pulverize the soil less than disk implements.

Figure 2.—A good trash cover on summerfallow is the best possible insurance against soil drifting.

Stubble Burning

Stubble should never be burned. Crop residues are the most important insurance available against soil drifting. Sometimes extra effort will be required to prepare a seedbed on land carrying a very heavy stubble but this can always be accomplished without burning. Straw spreaders and cutters are useful additions to the combine when crops are heavy. Burning destroys the protective cover and hence the wind velocity at the ground surface is greatly increased.

Unprotected Knolls

In several prairie regions where the land is rolling or hummocky the knolls are very susceptible to wind erosion. Most of the topsoil has been lost from a large percentage of these knolls and the high-lime subsoil is exposed giving a whitish color to the surface. These so-called "limey knolls" are especially vulnerable to soil drifting. Frequently large fields have blown badly because drifting has begun on the exposed knolls. Once drifting begins the abrasive and bombarding action of the particles from the knolls, if wind continues, causes soil from all over the field to begin moving. These knolls and other focal points such as dunes should receive special attention. If trash cover is not adequate they should receive an application of straw or manure. In many cases a farmer would be well advised to seed them permanently to grass.

CONTROL

Soil drifting can only be controlled by reducing the wind velocity at the surface or by maintaining soil aggregates sufficiently large to withstand wind action. If drifting has started, emergency control methods must be applied immediately.

Figure 3.—The combination of strip farming and surface tillage to preserve trash will "windproof" almost any agricultural soil.

Preservation of Vegetative Residues

Crop and weed residues, usually referred to as trash cover, are the most practical means of protecting soil against wind erosion. Weed growth is much less effective than stubble. Weed material decomposes faster than crop residues and in addition many weeds commonly break off at the soil surface and blow away. This vegetative material is much more effective than a cloddy structure because clods break down into erodible particles under weather agencies. The stubble from an average grain crop will prevent almost any soil from blowing throughout the summerfallow period if it is carefully preserved on top of the ground.

Tall stubble is more effective in reducing the wind velocity than the same weight of short stubble. This emphasizes the importance of tilling the field in such a manner that the stubble remains erect and anchored. Stubble incorporated with the soil is not nearly so effective as when it is left on top. Furthermore, as stubble gradually decomposes on top of the ground following usual surface tillage methods, certain sticky substances are liberated which provide cementing material to bind the small soil particles together into aggregates which will resist soil drifting.

Proper Choice and Use of Tillage Implements

From the point of view of wind erosion control, the ideal tillage implement is one that will destroy weed growth and maintain the trash on the surface without pulverizing the soil excessively. The blade-type implements have been used very successfully in the drier parts of the prairies. Their

use is recommended. Blade cultivators reduce the weight of the trash cover about 10 per cent each time they are used to till a field. Thus after three or four strokes more than half the vegetative residues remain on the surface for protection.

Field cultivators, such as the duckfoot, do a good job of weed control and also are fairly effective in maintaining crop residues on the surface. Heavy-duty cultivators work well in heavy trash cover and also penetrate firm soil readily and maintain a constant depth. The rod weeder is a good implement to use for the next stroke following the use of a cultivator.

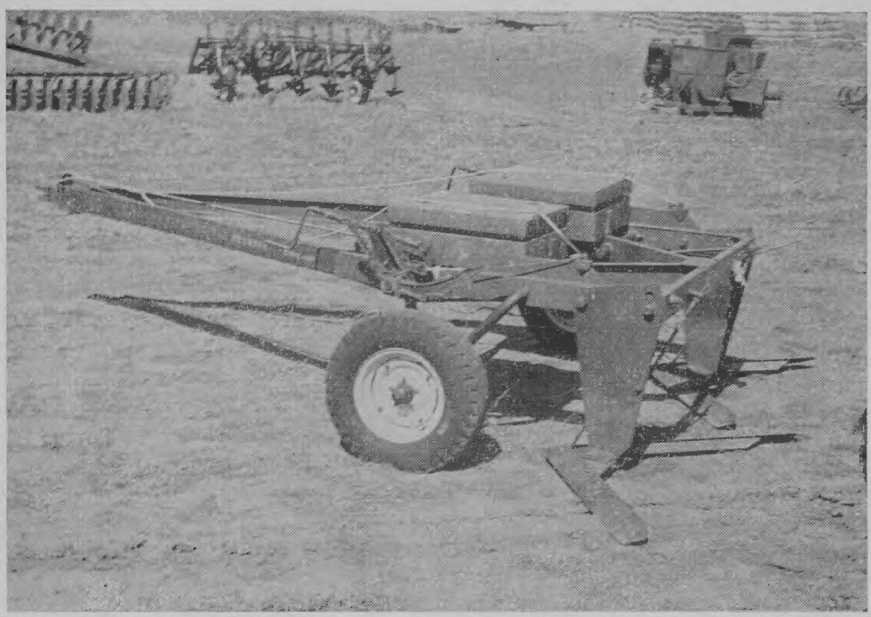

Figure 4.—Blade cultivators are the most effective implements available for preserving the crop residues on the surface of the soil.

One-way disks and wide level diskers are valuable implements if properly handled but often their misuse has contributed to soil drifting. Carefully operated one-ways reduce the trash cover by about 50 per cent per stroke; one-ways operated too deeply are much more severe. Wide level diskers are misused even more than standard one-ways by being operated at excessive speeds.

Following a heavy crop the one-way or wide level disker may be used for the first tillage operation on the summerfallow with subsequent strokes by the blade cultivator or the duckfoot cultivator and rod weeder. If a satisfactory weed kill can be obtained it may be better to use the blade cultivator for the first stroke since this implement works best when used before rather than after machines which turn the stubble under. The disk machines should not be used as the only tillage implements for the summerfallow. If disk implements are used a second time the position of the corners should be changed by doing a strip at the end of the field first. This will eliminate extra working and pulverization on old corners. If only a light stubble covers the land at the beginning of the summerfallow year disks should not be used.

When there is little vegetative cover to protect the surface the moldboard plow will usually turn up sufficient lumps to "wind proof" loam soils. There seems to be little advantage in plowing a heavy clay soil or a light sandy soil; both break down very quickly into small particles which are subject to erosion.

Many fields are made susceptible to drifting by unnecessary and unwise cultivation. Tillage of fallow should be avoided when there are no weeds to destroy. Summer harrowing and fall "levelling" are both bad practices.

Strip farming has been helpful in controlling soil drifting. The alternate strips of stubble serve as traps for soil which begins to blow off the summer-fallowed areas. Strip farming is most effective when used in conjunction with other control measures, particularly the preservation of trash cover. A strip width of 10 to 16 rods has been found most satisfactory. However, 40-rod strips are probably preferable to the summerfallowing of quarter-section blocks as is practised in many areas. Wherever practical, strips should be laid out at right angles to the direction of the prevailing winds.

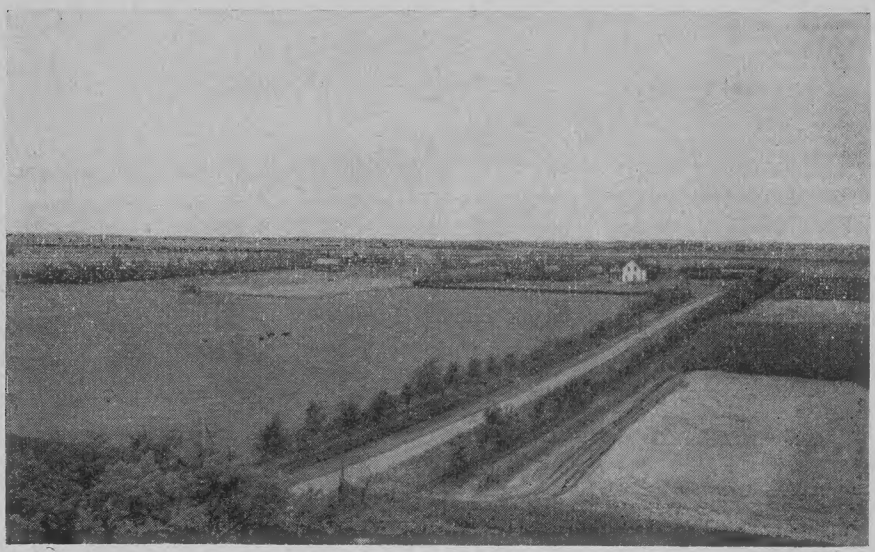

Figure 5.—Windbreaks, strip farming, trash covers, and grass all combine on this farm to provide pleasant surroundings and stable fields.

Seeding Down to Grass

Grass is nature's cover for the prairies and provides adequate protection against wind erosion. Thus it has been reasoned that crop soils would be less subject to erosion if they were returned to grass periodically. Experiments conducted in the drier parts of the prairies show that fields that have been down to grass for three or four years and then broken are more resistant to blowing because the roots of the grass tend to bind soil particles together into larger aggregates. As soon as these grass roots decompose the soil is again vulnerable to wind erosion. The duration of protection is not sufficiently long to justify short-term grass rotations for wind erosion control in the semi-arid prairie area. However, in the moister regions such as the black soil zone, where grass is more readily established and grows more vigorously, the prospects are better. On some marginal lands drifting is frequently a serious problem and these fields should be retired permanently to grass.

Cover Crops

Cover crops have proved valuable in controlling soil drifting in several widely separated areas of the prairies. The recommended practice is to seed oats or wheat on the summerfallow at about half a bushel per acre. The date of seeding should be about August 1 so that ample growth will be made to protect the soil through the autumn, winter and early spring. Earlier seeding provides more growth than is necessary and hence impoverishes the soil of moisture. Experiments in the foothills region and the black soil zone of Alberta and on the Regina plains have shown that cover crops provide adequate soil drifting control and in most years do not reduce the yield of the crop the following season. In some districts cover crops have given a profitable revenue by providing pasture for cattle. If this is contemplated

Figure 6.—This unprotected field was drifting very badly but was stabilized for several months in the Chinook belt by this thorough listing job.

oats make the most satisfactory crop and seeding should be done a little earlier than usual and at a higher rate. In the drier parts of the prairies cover crops are not practical because they use up more moisture than is usually replenished by the winter and spring precipitation. Under such conditions a distinct reduction in yield commonly occurs.

Corn seeded in rows two rods apart has provided some protection against soil drifting and has been effective in trapping snow on fallows to increase the moisture supply.

Shelterbelts

Shelterbelts are an effective means of reducing wind velocity and hence soil drifting. Their use is recommended wherever practical.

EMERGENCY CONTROL METHODS

Listing

In years of very light crop or when for other reasons there may be little trash cover, summerfallows will be bare and susceptible to wind erosion. Such fields may be "windproofed" by deep listing which will turn up some large lumps and provide furrows to trap any soil which begins to move. It is important to space the furrows sufficiently far apart that the ridges are flat on top. Peaked ridges are much more susceptible to blowing. The plowing of furrows at intervals of a few feet throughout an unprotected area or one that is actually drifting is similar to listing in effectiveness although not usually so long lasting. Listing is so effective and so easily

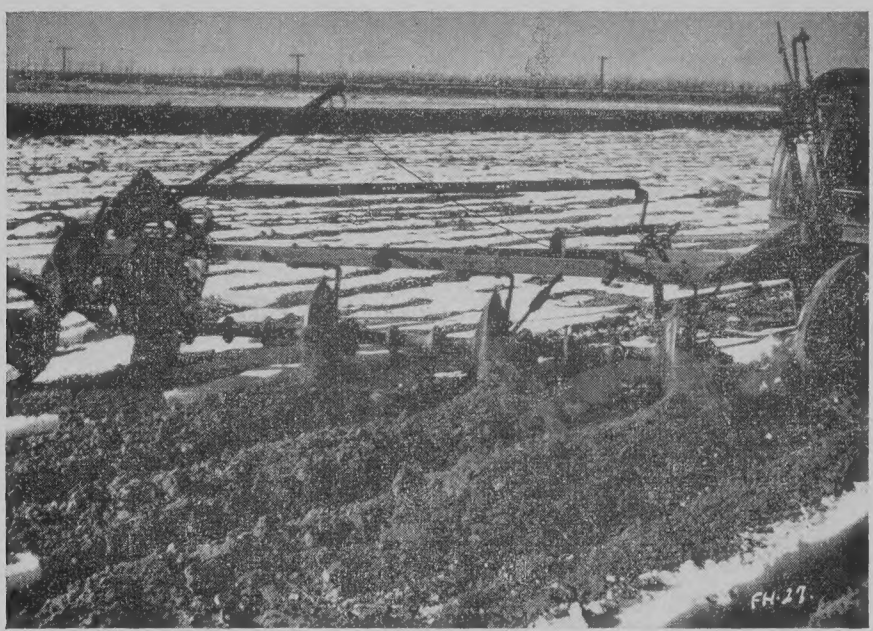

Figure 7.—A "frozen soil" lister can be readily fashioned from a one-way disk. This implement is very effective in stopping winter drifting.

done that it seems wise to advise that every field which appears to be in danger of drifting should be listed and wherever drifting gets beyond control by other measures, listing should be done.

Listing on Frozen Soil

In the Chinook belt often fields are blown bare of snow and soil drifting occurs in the winter when the soil is frozen. This can be controlled by listing with a one-way disk with all but every fifth disk removed and the hitch adjusted. Chisel plows also may be used to advantage if equipped with 2-inch chisel points.

Spreading Straw or Manure

Soil drifting may be controlled by spreading manure or wet straw on the soil. This method is especially applicable to small focal points such as dunes along fence rows or limy knolls where drifting is likely to begin.

Ridging With Cultivator

If action is taken as soon as a field begins to blow, the drifting often can be stopped by roughening the surface with a cultivator. This implement will usually bring up a few clods and allow the fine material to sift down into the protection of the larger particles. A stroke with a spike tooth harrow may temporarily halt soil drifting on a field and give time for more permanent methods to be applied. These methods should not be used if the soil is very dry.

CONCLUSION

Wind erosion causes serious depletion of Canada's greatest national resource—the soil. Much of this loss occurs unnecessarily because known principles of soil conservation are not applied. Methods of soil drifting control have been worked out for almost all situations. In one large area in southern Alberta, which is subjected to more wind than any other agricultural region of Canada and also has a very erodible soil, soil drifting formerly was serious every year but now has been virtually eliminated. This is the area where strip farming originated and where blade cultivators were developed. Similarly, practical methods of wind erosion control can be applied to the entire prairie area.

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